Preliminary Bulletin

NEW REAL-TIME MONITOR COMPUTER PROGRAM

COMPUTER CONTROL COMPANY, INC.

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introduction

A new, versatile computer program, developed by Computer Control Company, Inc., is now available to 3C computer users. Designated the Real-Time Monitor (RTM), the program increases efficiency of real-time computer systems by automatically time sharing the capabilities of the computer between a combination of real-time and free-time programs. For example, a process control computer which is actively performing control functions for perhaps 40% of the time can be used to either control more processes or run free-time programs in the remaining 60% of the time. With the RTM program, business data processing, debugging, DAP* assemblies, FORTRAN IV compilations, or scientific calculations can be performed without interfering with the primary job of the computer; namely, the real-time applications.

RTM is composed of a set of integrated programs which jointly perform the required scheduling and control functions necessary to assure the coordinated execution of the several programs sharing the computer's capabilities. The three programs which form the RTM are: the DIRECTOR, the INTERRUPT RECOGNIZE AND RECORD routine, and the INPUT-OUTPUT CONTROL routine.

director

The DIRECTOR is responsible for controlling execution of system tasks, which may be either application programs or system programs. Control is maintained through the use of a Task Index composed of blocks of control information for each task. The DIRECTOR is entered whenever an event occurs that causes a status change. It is the function of the DIRECTOR at this time to determine which system task to activate according to the information in the Task Index. The DIRECTOR always selects the highest priority task of those eligible and sets the appropriate memory lockout mask and interrupt inhibit mask prior to beginning the task. The selected task is executed to completion, or until a delay point is reached (i.e., interrupt or I/O operation). On completion, control is returned to the DIRECTOR.

interrupt recognize and record

The INTERRUPT RECOGNIZE AND RECORD routine (IRR) is responsible for receiving and recording the occurence of all interrupts in the system.

The receipt of an interrupt is interpreted as a request for the execution of a system task. Therefore, the recording of the interrupt consists of setting the next execution time of the task to a value which causes the task to be executed the next time the DIRECTOR is active. (This task will not be executed at this time, however, if it is not the highest priority task eligible for execution.) In addition, the IRR stores the contents of the active register in the locations assigned to the group for the task interrupted and takes the appropriate exit either to the DIRECTOR or to I/O Control, according to the type of interrupt.

*DAP is Computer Control Company's assembly language

input-output control

INPUT-OUTPUT CONTROL (IOC) initiates and monitors *all input and output operations.* This wide range of services is available due to the extremely modular design of the IOC which allows plug-in packages to be added to the basic I/O Processor. This insures that each computer system need use only those I/O services required by that system. The basic I/O Processor provides bookkeeping and switching functions, i.e., it relays each request to the proper processor for further action.

For typical devices, further processing is done in the Request, Ready or Cancel Processors. The Request Processor initiates and monitors a request for input or output; the Ready Processor provides instantaneous monitoring of an I/O request previously made through the Request Processor; the Cancel Processor terminates an I/O request previously made through the Request Processor. Both the Request and Ready Processors function in the "hold" or "no-hold" modes. The "hold" mode indicates to IOC that the calling task must be suspended until the function requested is finished, whether it be an initial request for input/output, or an inquiry about the completion of a previous request. The "no-hold" mode indicates that control should be returned immediately to the calling task after initiating the function. All I/O operations are activated and controlled through the use of interrupts.

communication

Each system task communicates with the RTM by executing an appropriate "illegal" instruction (I/O, HALT, or attempts to modify protected areas of memory) to cause an interrupt which transfers control to the DIRECTOR. Information or instructions to the DIRECTOR are made available by placing them in a convenient location before causing the interrupt.

A system task may obtain data from another system task by reading the information from the appropriate memory locations. However, a system task may *not* transfer data into storage locations assigned to a different task.

All communication between the RTM programs and the operator is conducted through the typewriter. The operator adds or deletes programs from the Task Index, cancels or initiates I/O requests, executes free-time programs and initiates special action programs such as emergency scans.

hardware configuration

A fundamental design concept in the Real-Time Monitor is that of modularity. One of the ramifications of this feature is that, for each of the hardware subsystems included in the DDP product line, there can be added a software module to provide for RTM operation.

The minimum hardware system in which the RTM can operate includes 8,192 words of core memory, a typewriter or teletype, a real-time clock, eight priority interrupts, high speed I/O such as paper tape or cards and memory lockout.

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